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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/651,031
Filing Date: August 30, 2000
Appellant(s): HUMMEL ET AL.

George H. Gates
Reg. No. 33,500
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed June 17th, 2005.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of The Claimed Invention

The summary of the claimed invention is contained in the brief.

(6) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(7) Prior Art of Record

U.S. Patents

US 5,594,651	James A. St. Ville	01-1997
US 5,289,567	James W. Roth	02-1994
US 5,774,124	Takayuki Itoh	06-1998

(8) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 1 – 9, 12 – 13, 16 – 18 and 20 – 22 are rejected under 35 U.S.C. 102(b) as being anticipated by St. Ville (U.S. Patent No. 5,594,651, and referred to as Ville hereinafter).

Regarding independent claim 1, Ville teaches

- A method (new method, Fig. 3) for defining at least one parameter (forces & potentials, Fig. 3) for a finite elements analysis (FEA) calculation (Finite element analysis, Fig. 3) in a computer-assisted drafting (CAD) program (new method, Fig. 3).
- Determining a body (the object, Col 4, Line 44) for which parameter (manufacturing parameter, Col 4, Line 59) is to be defined (determined, Col 4, Line 61), body (the object, Col 8, Line 59) being an entity processed (geometrically model, Col 8, Line 58) by CAD program (computer-aided design, Col 8, Line 58); and
- Using at least one graphical function (graphics software program, Col 13, Line 56) of CAD program (computer-aided design, Col 13, Line 55 and Col. 1, Line 49) to define a region (region A – F, Fig. 5A) within a face of body (Fig. 5A), region being used to define a load/support condition for FEA calculation (Identify forces applied to object intended application, Fig. 1, Sheet 1/11, Fig. 2).

Ville further teaches geometry includes dimensions (region), tolerances, surface finish, definitions of surfaces and edges (face), and, in some cases, the fit between two mating parts (body). (Col. 1, Line 46 – 49)

Regarding independent claims 16 and 20, Ville teaches A computer program product (various functional modules, Col 14, Line 61) for execution by a general purpose computer (personal computer, Col 14, Line 63) for defining at least one parameter for a finite elements analysis (FEA) (finite element module, Col 15, Line 6) calculation in a computer-assisted drafting (CAD) program (computer aided design, Col 13, Line 55), computer program product including instructions (Three dimensional graphics software program, Col 13, Line 56) for determining a body (the object, Col 4, Line 47) for which parameter (manufacturing parameters, Col 4, Line 59) is to be defined (determined, Col 4, Line 61), body (the object, Col 8, Line 59) being an entity processed (geometrically model, Col 8, Line 58) by CAD program (computer aided design, Col 8, Line 58), and computer program product (various function module, Col 14, Line 61) further including instructions (Three dimensional graphics software program, Col 13, Line 56) for defining a region within a face of body (Define Initial Design Geometry, Fig. 1) using at least one graphical function (graphics software program, Col 13, Line 56) of CAD program (computer aided design, Col 13, Line 55), region (region, Col 12, Line 53) being used to define a load/support condition for FEA calculation (Identify forces applied to object intended, Fig. 1, Fig. 2).

Regarding dependent claim 2, Ville teaches selecting a type of load/support condition (force, stress-field, Col 1, Line 29, Fig. 2) to be defined (determination, Col 1, Line 29), selecting face of body (Fig. 6, Sheet 7/11), and defining further properties of load/support condition (The object maybe redesigned and/or new material may be selected, Col 1, Line 37, Fig. 2).

Regarding dependent claim 3, Ville teaches a load condition inside region, a load condition outside of region, a support condition inside region, and a support condition outside of region. (Each force which will be applied to the object during intended use, and the points and direction of application of the respective forces, are identified, Col 1, Line 48, Fig. 2) (Strains and stresses, Col. 2, Line 45)

Regarding dependent claims 4, 17 and 21, Ville teaches graphical function (graphics software program, Col 13, Line 56) of CAD program (computer-aided design, Col 13, Line 55) is a function selected from the following group of functions: a function of drawing (paint, Col 8, Line 66) an object (realistic picture, Col 8, Line 66), object being used to delimit region (dividing the geometric model of the object, Col 9, Line 60), and a function of selecting (variety of element shapes may be used, Col 9, Line 64) an object (realistic picture, Col 8, Line 66), object being used to delimit region.

Regarding dependent claim 5, Ville teaches object is drawn on face of body (Fig. 6, Sheet 7/11).

Regarding dependent claim 6, Ville teaches the view in which body (realistic picture, Col 8, Line 66) is displayed by CAD program (computer graphics output devices, Col 8, Line 67) is temporarily changed (modified, Col 9, Line 6) for facilitating drawing of object (initial geometric model, Col 9, Line 5).

Regarding dependent claim 7, Ville teaches calculating (discretizing, Col. 18, Line 43) a projection of object (geometric model, Col. 18, Line 43) onto face (finite element, Col. 18, Line 44) for determining (generating, Col. 18, Line 42) region (computerized mathematical model, Col. 18, Line 42).

Regarding dependent claim 8, Ville teaches graphical function (computer graphics output devices, Col 8, Line 67) of CAD program (computer aided design, Col 8, Line 58) is a function of subtracting (modified, Col 9, Line 6) a selected body (the object, Col 8, Line 59) from body (the object, Col 4, Line 47) determined in step (a).

Regarding dependent claims 9, 18 and 22, Ville teaches step (b) is repeated to define a plurality of regions within at least one face of body (Fig. 6, Sheet 7/11), each region of plurality of regions being used to define at least one load/support condition for FEA calculation (Identify force applied to object in intended application, Fig. 1, Sheet 1/11, Fig. 2).

Regarding dependent claim 12, Ville teaches face of body is a curved face. (Fig. 6, Sheet 7/11)

Regarding dependent claim 13, Ville teaches region used to define load/support condition is a curved region. (Fig. 6, Sheet 7/11)

Claim Rejections - 35 USC § 103

2. Claim 10, 11, 19 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ville and in view of Roth (U.S. Patent No. 5,289,567).

Regarding dependent claim 10, Ville teaches, defines a region (define initial design geometry, Fig. 1, Sheet 1/11) to define a load support condition for FEA calculation (Identify force applied to object in intended application, Fig. 1, Sheet 1/11, Fig. 2).

Ville does not teach steps of determining intersection points between the defined plurality of regions and determining overlapping portions of plurality of regions.

Roth teaches at least one of the steps of determining (checked, Col 8, Line 30) intersection points (intersection, Col 8, Line 31) between the defined pluralities of regions (bounding boxes, Col 8, Line 31) and determining (determine, Col 8, Line 38) overlapping portions (overlapping points, Col 8, Line 38) of plurality of regions (bounding boxes, Col 8, Line 31).

It would have been obvious to a person of ordinary skill in the art to modify the teaching of Roth to include "steps of determining intersection points between the defined plurality of regions and determining overlapping portions of plurality of regions." with the motivation to provide for determining if there exist over lapping points or line segments in the model. And a logarithmic time per line rather than a linear query time is achieved.

Regarding dependent claims 11, 19 and 23, Ville teaches the loads (loads, Col 4, Line 4) acting on (applied to, Col 4, Line 4) regions (the object, Col 4, Line 4) are defined as the sums

(displacement resulting, Col 4, Line 6) of the individual loads acting on each region (application of the loads, Col 4, Line 7).

Ville does not teach overlapping portions of plurality of regions.

Roth teaches overlapping portions (overlapping points, Col 8, Line 38) of plurality of regions (bounding boxes, Col 8, Line 31).

It would have been obvious to a person of ordinary skill in the art to modify the teaching of Roth to include "overlapping portions of plurality of regions." with the motivation to provide for determining if there exist over lapping points or line segments in the model. And a logarithmic time per line rather than a linear query time is achieved .

3. Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ville and in view of Itoh et al. (U.S. Patent No. 5,774,124 and referred to as Itoh hereinafter).

Regarding dependent claim 14, Ville teaches (a) determining a body (the object, Col 4, Line 47) for which parameter (manufacturing parameter, Col 4, Line 59) is to be defined (determined, Col 4, Line 61), body (the object, Col 8, Line 59) being an entity processed (geometrically model, Col 8, Line 58) by CAD program (computer-aided design, Col 8, Line 58); and (b) using at least one graphical function (graphics software program, Col 13, Line 56) of CAD program (computer-aided design, Col 13, Line 55) to define a region within a face of body (define initial design geometry, Fig. 1, Sheet 1/11), region being used to define a load/support condition for FEA calculation (Identify forces applied to object intended application, Fig. 1, Sheet 1/11).

Ville does not teach further step of determining contact points of region to an edge of face.

Itoh teaches further step of determining contact (aligned along, Col 2, Line 32) points of region (region boundary, Col 2, Line 32) to an edge of face (sides of the element, Col 2, Line 31).

It would have been obvious to a person of ordinary skill in the art to modify the teaching of Itoh to include "further step of determining contact points of region to an edge of face." with the motivation to provide a method and system for automatically generating quadrilateral meshes for reducing the problem to one of a finite number of unknowns by dividing the solution region into elements and by expressing the unknown field variable in terms of assumed approximating functions within each element.

Regarding dependent claim 15, Ville teaches (a) determining a body (the object, Col 4, Line 47) for which parameter (manufacturing parameter, Col 4, Line 59) is to be defined (determined, Col 4, Line 61), body (the object, Col 8, Line 59) being an entity processed (geometrically model, Col 8, Line 58) by CAD program (computer-aided design, Col 8, Line 58); and (b) using at least one graphical function (graphics software program, Col 13, Line 56) of CAD program (computer-aided design, Col 13, Line 55) to define a region within a face of body (define initial design geometry, Fig. 1, Sheet 1/11), region being used to define a load/support condition for FEA calculation (Identify forces applied to object intended application, Fig. 1, Sheet 1/11).

Ville does not teach mesh elements are generated in a meshing step of said FEA calculation such that the borders of the mesh elements follow the borders of said region.

Itoh teaches mesh elements (mesh division, Col 1, Line 18) are generated in a meshing step (dividing, Col 1, Line 18) of FEA calculation (finite element analysis, Col 1, Line 20) such that the borders of the mesh elements (sides of elements, Col 2, Line 32) follow (aligned along, Col 2, Line 33) the borders of region (region boundary, Col 2, Line 33).

It would have been obvious to a person of ordinary skill in the art to modify the teaching of Itoh to include "mesh elements are generated in a meshing step of said FEA calculation such that the borders of the mesh elements follow the borders of said region." with the motivation to provide a method and system for automatically generating quadrilateral meshes for reducing the problem to one of a finite number of unknowns by dividing the solution region into elements and by expressing the unknown field variable in terms of assumed approximating functions within each element.

(11) Response to Argument

Regarding Claims 1, 16 and 20

Appellants' argument regarding "Ville does not mention the integration of FEA function into a CAD program" (Page 5, Line 4 – 5 of paragraph C – 1) is disagreed with. Appellants claim "defining at least one parameter for a finite element analysis (FEA) calculation in a computer-assisted drafting (CAD) program" (Claim 1, Lines 1 – 2) and Ville discloses a method (new method, Fig. 3) for defining at least one parameter (forces & potentials, Fig. 3) for a finite

elements analysis (FEA) calculation (Finite element analysis, Fig. 3) in a computer-assisted drafting (CAD) program (Col. 8, Lines 58 – 67 and Fig. 3).

Appellants' argument regarding "Ville does not disclose the feature that a graphical function of the CAD program can be used to define a region within a face of a body, the region being used to define a load support condition for an FEA calculation" (Page 6, Lines 1 – 3) is disagreed with, Ville discloses "one graphical function (graphics software program, Col 13, Line 56) of CAD program (computer-aided design, Col 13, Line 55 and Col. 1, Line 49) to define a region (region A – F, Fig. 5A) within a face of body (Fig. 5A), region being used to define a load/support condition for FEA calculation (Identify forces applied to object intended application, Fig. 1, Sheet 1/11, Fig. 2). Also, Ville discloses geometry includes dimensions (region), tolerances, surface finish, definitions of surfaces and edges (face), and, in some cases, the fit between two mating parts (body) (Col. 1, Line 46 – 49). Further, Ville discloses a new method (Fig. 3) with CAD generating parameter (input boundary conditions, Including Forces and Potentials, 22, 23 in Figure 3) for FEA calculation (see also 801, 802 of Fig. 8). More paragraphs disclosed in Ville (Col. 1, Line 15 – Col. 2, Line 3 and Fig. 1) have been cited by examiner in Office Action describing the relationships between FEA and CAD regarding stress analysis. For example, Ville discloses " The initial design geometry may be created using computer-aided-design (CAD) techniques known in the art. Each force which will be applied to the object during intended use, and the points and direction of application of the respective forces, are identified at step 12".

Appellants' argument regarding "Ville states (1) the load/support conditions are defined not during the CAD steps on the geometric model data, but during the FEA steps on the finite

element model data, (2) no graphical CAD function is used for defining the load/support conditions, (3) only forces acting on points and not forces acting on regions within faces can be defined, is away from the invention" (Page 8, Lines 11 – 18) is disagreed with. Based on the language claimed in claim 1 (Lines 5 – 7), "using at least one graphical function of said CAD program to define a region within a face of said body, said region being used to define a load/support condition for said FEA calculation", a load/support condition does not necessarily to be defined under CAD program steps and CAD function does not necessarily defining the load/support conditions. Further, appellants claim for a region, yet, a region can also be treated as a node.

Regarding Claim 2 (claim 17 and 21 similar with claim 4, not claim2)

Appellants' argument regarding "nowhere does the reference teach or suggest these limitations of the claim" is disagreed with. Ville teaches selecting a type of load/support condition (force, stress-field, Col 1, Line 29, Fig. 2) to be defined (determination, Col 1, Line 29), selecting face of body (Fig. 6, Sheet 7/11), and defining further properties of load/support condition (The object maybe redesigned and/or new material may be selected, Col 1, Line 37, Fig. 2)

Regarding Claim 3

Appellants' argument regarding "nowhere does the reference teach or suggest these limitations of the claim" is disagreed with. Ville teaches a load condition inside region, a load condition outside of region, a support condition inside region, and a support condition outside of

region. (Each force which will be applied to the object during intended use, and the points and direction of application of the respective forces, are identified, Col 1, Line 48, Fig. 2) (Strains and stresses, Col. 2, Line 45)

Regarding Claims 4, 17 and 21

Appellants' argument regarding "nowhere does the reference teach or suggest drawing or selecting an object, wherein the object is used to delimit a region" (Page 13, Lines 6 – 8). Further recite, "of course, known that CAD programs generally have functions to draw or select objects", Ville discloses a CAD program and appellants agree CAD programs generally have functions to draw or select objects. Ville further discloses delimit a region (dividing the geometric model of the object, Col 9, Line 60)

Regarding Claim 5

Appellants' argument regarding "nowhere does the reference teach or suggest said object is drawn on said face of said body. Examiner's answer similar with answer to argument of claims 4, 17 and 21.

Regarding Claim 6

Appellants' argument regarding "nowhere does the reference teach or suggest temporarily changed for facilitating drawing of said object" is disagreed with. Ville discloses a CAD program and it is known having a undo/redo command for undo/redo modifications.

Regarding Claim 7

Appellants' argument regarding "nowhere does the reference teach or suggest calculating a projection of said object onto said face for determining said region" is disagreed with. Ville discloses calculating (discretizing, Col. 18, Line 43) a projection of object (geometric model, Col. 18, Line 43) onto face (finite element, Col. 18, Line 44) for determining (generating, Col. 18, Line 42) region (computerized mathematical model, Col. 18, Line 42). "discretizing" is projection of element onto a face for determining regions.

Regarding Claim 8

Appellants' argument regarding "nowhere does the reference teach or suggest subtracting a selected body" is disagreed with. Ville discloses a graphical function (computer graphics output devices, Col 8, Line 67) of CAD program (computer aided design, Col 8, Line 58) is a function of subtracting (modified, Col 9, Line 6) a selected body (the object, Col 8, Line 59) from body (the object, Col 4, Line 47) determined in step (a)

Regarding Claims 9, 18 and 22

Appellants' argument regarding "nowhere does the reference teach or suggest repeatedly defining regions" is disagreed with. Ville teaches repeated to define a plurality of regions within at least one face of body (Fig. 6, Sheet 7/11), each region of plurality of regions being used to define at least one load/support condition for FEA calculation (Identify force applied to object in intended application, Fig. 1, Sheet 1/11, Fig. 2). A plurality of regions need plurality of defining for each regions.

Regarding Claim 12

Appellants' argument regarding "nowhere does the reference teach or suggest face of the body is a curved face" is disagreed with. Ville teaches a heel (in Fig. 6) is has a curved face.

Regarding Claim 13

Appellants' argument regarding "nowhere does the reference teach or suggest face of the body is a curved face" is disagreed with. Ville teaches a heel (in Fig. 6) is has a curved face.

Regarding Claims 10, 11, 19 and 23

Appellants' argument regarding "nowhere does the reference teach or suggest determining intersection points between the regions and determining overlapping portions of the region" is disagreed with. Roth teaches at least one of the steps of determining (checked, Col 8, Line 30) intersection points (intersection, Col 8, Line 31) between the defined pluralities of regions (bounding boxes, Col 8, Line 31) and determining (determine, Col 8, Line 38) overlapping portions (overlapping points, Col 8, Line 38) of plurality of regions (bounding boxes, Col 8, Line 31). The term, "portions", could be points.

The motivation can be found in Specification of Roth reference (Col. 8, Lines 38 – 41)

Regarding Claims 14 and 15

Appellants' argument regarding "nowhere does the reference teach or suggest determining contact points of the region to an edge of said face" is not agreed with. Itoh teaches

determining contact (aligned along, Col 2, Line 32) points of region (region boundary, Col 2, Line 32) to an edge of face (sides of the element, Col 2, Line 31).

The motivation can be found in reference Itoh (Col. 1, Lines 16 – 17) and reference Ville (Col. 1, Line 66 – Col. 2, Line 3).

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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